WHAT IS CLAIMED IS:

1. A method for measuring pitch in data obtained from metrology and imaging systems, the method comprising:

obtaining a data set from a metrology or an imaging instrument;

converting the data set into digital format if not already in that format;

mapping the digitized data set into a one-dimensional profile data if the digitized data set is not already one-dimensional, the one-dimensional profile data being denoted by f(x) being a function of x position values corresponding to equally spaced or nearly equally spaced pixels;

constructing a criteria function g(T) as a one-dimensional data array from the profile data f(x) or any of its derivatives and a translation of the profile data f(x) denote by f(x+T) or any of its derivatives, wherein T represents the amount of translation, and g(T) being a function of T translation values corresponding to equally spaced or nearly equally spaced pixels;

determining a value of translation T either as a whole pixel or with subpixel interpolation such that the magnitude of g(T) would be either a maximum or a minimum whichever appropriate at said value, wherein said value is not zero; and

reporting said value as the pitch in the data set.

2. The method of claim 1 wherein said data set is a function of one or more variables including spatial dimensions x, y, z, time, or index in a sequence of images.

3. The method of claim 1 wherein the instrument is any one of cameras including CCD cameras, optical microscopes, scanning electron microscopes including top down, tilt, and cross section; scanning probe microscopes including atomic force microscopes and profilers; scanning ion microscopes; transmission electron microscopes; scanning optical microscopes; microscopes in analytical instruments; defect detection and inspection microscopes whether optical or scanning electron; microscopes in lithography systems including ion beam, x ray, optical, UV, deep UV and extreme UV lithography systems, thermal imaging systems, medical imaging devices such as magnetic resonance imaging, CAT Scan; ultrasound and other imaging systems such as sonar.

4. The method of claim 1 wherein:

the obtained data set is one or more image(s) of portions of a sample, and

the one-dimensional profile data f(x) is obtained from the image(s) through one or more mathematical operations including operations on the obtained data set or the one-dimensional profile data to reduce any noise in the data or to shift the average of the data or to remove any linear or higher order trend in the data, summing, averaging with or without weights, median, and averaging with data culling.

5. The method of claim 4 wherein the gray scale image is obtained by one of cameras including CCD cameras, optical microscopes, scanning electron microscope including top down, tilt, and cross section, scanning ion microscope; transmission electron microscope; microscopes in analytical instruments; defect detection and inspection microscopes whether optical or scanning electron; microscopes in lithography systems including ion beam, x ray, optical, UV, deep UV and extreme UV lithography systems, thermal imaging systems, medical imaging devices such as magnetic resonance imaging, CAT Scan; ultrasound and other imaging systems such as sonar.

6. The method of claim 5 wherein:

the criteria function g(T) is constructed from the profile data f(x) and a translation of the profile data f(x) denote by f(x+T) using autocorrelation of either the profile data f(x) or any of its derivatives, and

computation of g(T) is performed with or without normalization of profile data f(x) or its derivatives, with or without subtracting a background level from profile data f(x) or its derivatives, with or without excluding portions of the profile data f(x) or its derivatives based on their magnitude, with or without shifts in the magnitude of the profile data f(x) or its derivatives, with or without background uniformity compensation in f(x) or its derivatives, with or without allowance for one or more regions in the argument of the profile data or its derivatives that can be defined to be excluded from the computations, and by either truncating the summation or zero padding or replication to represent the translated values of the profile data or its derivatives, or any combination thereof.

7. The method of claim 6 wherein the reporting act comprises:

reporting one or more parameter(s) to convey information about the quality of the reported pitch.

8. The method of claim 4 wherein:

the criteria function g(T) is constructed from the profile data f(x) and a translation of the profile data f(x) denote by f(x+T) using autocorrelation of either the profile data f(x) or any of its derivatives, and

computation of g(T) is performed with or without normalization of profile data f(x) or its derivatives, with or without subtracting a background level from profile data f(x) or its derivatives, with or without excluding portions of the profile data f(x) or its derivatives based on their magnitude, with or without shifts in the magnitude of the profile data f(x) or its derivatives, with or without background uniformity compensation in f(x) or its derivatives, with or without allowance for one or more regions in the argument of the profile data or its derivatives that can be defined to be excluded from the computations, and by either truncating the summation or zero padding or replication to represent the translated values of the profile data or its derivatives, or any combination thereof.

9. The method of claim 8 wherein the reporting act comprises:

reporting one or more parameter(s) to convey information about the quality of the reported pitch.

10. The method of claim 1 wherein:

the data set includes one or more scan profile(s) obtained by scanning one or more time(s) the area of interest on a sample, and

the one-dimensional profile data f(x) is obtained from one or more scan profile(s) through one or more mathematical operations including operations on the obtained data set or the one-dimensional profile data to reduce any noise in the data or to shift the average of the data or to remove any linear or higher order trend in the data, summing, averaging with or without weights, median, and averaging with data culling.

11. The method of claim 10 wherein the instrument is one of scanning electron microscope including top down, tilt, and cross section, scanning probe microscope including atomic force microscope and profiler; scanning ion microscope; transmission electron microscope; scanning optical microscope; microscopes in analytical instruments; defect detection and inspection instruments; medical imaging devices such as CAT Scan.

12. The method of claim 11 wherein:

the criteria function g(T) is constructed from the profile data f(x) and a translation of the profile data f(x) denote by f(x+T) using autocorrelation of either the profile data f(x) or any of its derivatives, and

computation of g(T) is performed with or without normalization of profile data f(x) or its derivatives, with or without subtracting a background level from profile data f(x) or its derivatives, with or without excluding portions of the profile data f(x) or its derivatives based on their magnitude, with or without shifts in the magnitude of the profile data f(x) or its derivatives, with or without background uniformity compensation in f(x) or its derivatives, with or without allowance for one or more regions in the argument of the profile data or its derivatives that can be defined to be excluded from the computations, and by either truncating the summation or zero padding or replication to represent the translated values of the profile data or its derivatives, or any combination thereof.

13. The method of claim 12 wherein the reporting act comprises:

reporting one or more parameter(s) to convey information about the quality of the reported pitch.

14. The method of claim 10 wherein:

the criteria function g(T) is constructed from the profile data f(x) and a translation of the profile data f(x) denote by f(x+T) using autocorrelation of either the profile data f(x) or any of its derivatives, and

computation of g(T) is performed with or without normalization of profile data f(x) or its derivatives, with or without subtracting a background level from profile data f(x) or its derivatives, with or without excluding portions of the profile data f(x) or its derivatives based on their magnitude, with or without shifts in the magnitude of the profile data f(x) or its derivatives, with or without background uniformity compensation in f(x) or its derivatives, with or without allowance for one or more regions in the argument of the profile data or its derivatives that can be defined to be excluded from the computations, and by either truncating the summation or zero padding or replication to represent the translated values of the profile data or its derivatives, or any combination thereof.

15. The method of claim 14 wherein the reporting act comprises:

reporting one or more parameter(s) to convey information about the quality of the reported pitch.

16. The method of claims 1 wherein the criteria function g(T) is constructed from the profile data f(x) and a translation of the profile data f(x) denote by f(x+T) using autocorrelation of either the profile data f(x) or any of its derivatives.

17. The method of claim 1 wherein the computation of g(T) is performed with or without normalization of profile data f(x) or its derivatives, with or without subtracting a background level from profile data f(x) or its derivatives, with or without excluding portions of the profile data f(x) or its derivatives based on their magnitude, with or without shifts in the magnitude of the profile data f(x) or its derivatives, with or without background uniformity compensation in f(x) or its derivatives, with or without allowance for one or more regions in the argument of the profile data or its derivatives that can be defined to be excluded from the computations, and by either truncating the summation or zero padding or replication to represent the translated values of the profile data or its derivatives, or any combination thereof.

18. The method of claim 1 wherein the reporting act comprises:

reporting one or more parameter(s) to convey information about the quality of the reported pitch.

19. The method of claim 18 wherein the one or more parameter(s) include(s) the maximum or the minimum of the criteria function g(T) and the width of the peak or the trough in the vicinity of the corresponding maximum or minimum.

20. The method of claim 1 wherein said pitch in the data set is measured from a sample with a known physical pitch to establish the scale in the data set or the magnification of an image obtained from the system, or to calibrate the system .

21. The method of claim 1 further comprising:

obtaining a measurement for a physical pitch in a sample from said reported pitch, said data set having a known pixel size.

22. A method for measuring pitch in data obtained from metrology and imaging systems, the method comprising:

obtaining a data set from an imaging or metrology instrument;

converting the data set into digital format if not already in that format;

dividing the digitized data set into one or more data subsets;

mapping each digitized data subset into a one-dimensional profile data, each one-dimensional profile data being represented by a corresponding f(x);

constructing a criteria function g(T) from each profile data f(x) and its translation denote by f(x+T), wherein T represents the amount of translation and is varied over a range;

determining a value of translation T for each criteria function such that the magnitude of the corresponding g(T) would be either a maximum or a minimum whichever appropriate at said value, wherein said value is not zero; and

reporting a mathematical function of said values for said criteria functions as the pitch in the data set, said mathematical function including one or more of summing, averaging with or without weights, median, and averaging with data culling.

23. A method for measuring pitch in data obtained from metrology and imaging systems, the method comprising:

obtaining a data set from an imaging or metrology instrument;

converting the data set into digital format if not already in that format;

dividing the digitized data set into one or more data subsets, each data subset being denoted by a scalar function f(x), wherein x represents a vector;

constructing a criteria function g(T) from each scalar function f(x) and its translation denote by f(x+T), wherein T represents the translation vector whose individual components are varied over a corresponding range;

determining a value of translation vector T for each criteria function g(T) such that the magnitude of the corresponding g(T) would be either a maximum or a minimum whichever appropriate at said value, wherein said value is not zero; and

reporting a vector whose components are mathematical functions of the corresponding values for said criteria functions as a vector representation of the pitch in the data set.